

DOCUMENT RESUME

ED 234 770

IR 010 842

AUTHOR McLaren, Joan
TITLE The Information Technologies: Telidon and Education--Perspectives and Possibilities for a New Information Technology and Its Impact on Education.
INSTITUTION Manitoba Dept. of Education, Winnipeg. Instructional Media Services.
PUB DATE Jul 83
NOTE 45p.
PUB TYPE Information Analyses (070) -- Viewpoints (120) -- Reports - Descriptive (141)
EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTORS *Delivery Systems; *Educational Media; *Futures (of Society); *Information Networks; Instructional Innovation; Simulation; Teaching Methods; *Technological Advancement; *Videotex
IDENTIFIERS Information Society; Information Technology; Interactive Systems; *Telidon System

ABSTRACT

A discussion of the information revolution and society with the focus on education and a description of the current configuration of Telidon, a videotex system developed in Canada, provide the background for an in-depth exploration of the educational applications and capabilities of this new information technology. Capable of operating in either a one-way teletext or two-way videotex mode, Telidon is characterized as one of the major technological participants in the information revolution. Its role in bringing about and furthering the information society is discussed, as well as its potential for use at various levels of the educational system and in other locations such as the home and library. Topics highlighted are change and technology, functions of Telidon in educational technology, modes of instruction (passive, interactive, simulation, information resource), and educational communications (many-to-one, one-to-many, one-to-one, group-to-group, and network communication). A brief discussion of issues and implications for policy and a nine-page selected bibliography are included. (LMM)

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THE INFORMATION TECHNOLOGIES:

TELIDON AND EDUCATION ---

PERSPECTIVES AND POSSIBILITIES

FOR A NEW INFORMATION TECHNOLOGY

AND ITS IMPACT ON EDUCATION

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By Joan McLaren

Director
Instructional Media Services
Manitoba Department of Education
Winnipeg, Canada
July 1983

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INTRODUCTION

Rapid innovation has become commonplace for those individuals working in the field of technology. In fact, many developers spend considerable amounts of time speculating not merely about what will be available tomorrow, but about developments that are far in the future. A product that has been introduced relatively recently for home, business, and education markets offers, however, an exciting immediate potential for the coming-together of several technologies to create a powerful new learning tool. This product is videotex, the Canadian version of which is Telidon.

Telidon, a specific application of videotex developed by the Communications Research Centre of the Federal Government's Department of Communication, is the focus of interest for many innovative educators who are moving forward with projects to test this new medium for instructional purposes. Discussed here are some of the impacts, both current and projected, of this new information technology on education.

This paper discusses the information revolution and society with the focus on education; gives a brief description of the current Telidon configuration; and explores its educational application and capabilities, looking at the provision of education at various levels of the educational system and in other locations such as the home and library. A brief discussion of issues and implications for policy is also included.

I. THE INFORMATION SOCIETY

It has become almost trite to point out that the information revolution is bringing about profound technological and social changes in modern society. Characteristic of this revolution are explosive developments in electronic information technologies and their linkage into complex information systems having massive capacities; these can literally turn the world into the "global village" envisioned by McLuhan by putting people instantly in touch with one another and with information sources of all kinds. At the moment in time when

the quantities of information available have become too large for human beings to manage using the manual systems, new technologies have evolved which provide not only the capacity but the networks to make possible the access to and the manipulation of information in essential ways. The impacts of this revolution on individuals, institutions, and governments are profound, altering what they do, how it is done, and the ways in which they relate to one another and to the larger society.

The information industry, directly involved with producing, managing, and marketing information and the concomitant information technology, have become major components in the world and the national economy. The information sector, broadly defined, now accounts for over 60 percent of the economic activity of the United States,¹ and probably a similar portion of Canada's economy. Information services are a direct product of many companies, and business in general is beginning to consider information as a factor of production in the same fashion as land, labour and capital. In addition, access to data and the ability to manipulate and utilize it is becoming increasingly important to individuals in order to function effectively as students, consumers, citizens, and in relation to government. "Information literacy", whether it be in the area of computers, word processing, the creation of new knowledge, or the researching of existing knowledge now affects, and will have an accumulating effect, on the person's ability to become and remain employed.

The situation society faces is far from simple. Some major points that concern the topic here addressed are these:

- . The major advances being made by information technology are creating increasing demands for education and training across the continent; the penalties both economically and socially for refusing to meet these demands are becoming more and more serious in nature.
- . The information revolution is placing new stresses on such institutions as schools and libraries that have been traditional dispensers of education and information.

- . Educational technology already is playing a major role in the provision of education and training in some areas.
- . Technology has the potential to provide solutions to some of the current problems education now faces, and may well be utilized as a vehicle for doing so over the next decade.
- . At the same time, not enough is known about the psychological, social, and educational effects of the technological approach to education. Further research is needed before full-scale utilization at all levels of the education system takes place.

The information revolution places new demands on individuals and institutions, changing what they must know and do in order to take their places fully in modern society, and increasing the problems of those who cannot adapt. Automation in the factory, the office, and the library, along with management and information handling in such professions as the law and medicine, has had and will increasingly have a transforming effect on our lives.

Telidon is one of the major technological actors in the information revolution; its role in bringing about and furthering the information society is a crucial one. Let us look at how Telidon is impacting and might impact upon the field of education.

II. TELIDON: THE TECHNOLOGY

Telidon is both a technical achievement and a powerful social influence in the information revolution. A brief look at this technological development is appropriate at this point.

Telidon is the name of a specific videotex system, an information unit developed in Canada capable of operating in either a one-way teletext or a two-way videotex mode. Its graphics are superior to those of European first-generation information systems such as Prestel in Britain and Teletel in France.

Videotex is the name used for a whole class of electronic systems, of which Telidon is one. All videotex systems are comprised of five elements, as outlined by Madden (1979:3) and shown in the accompanying diagram (figure 1):

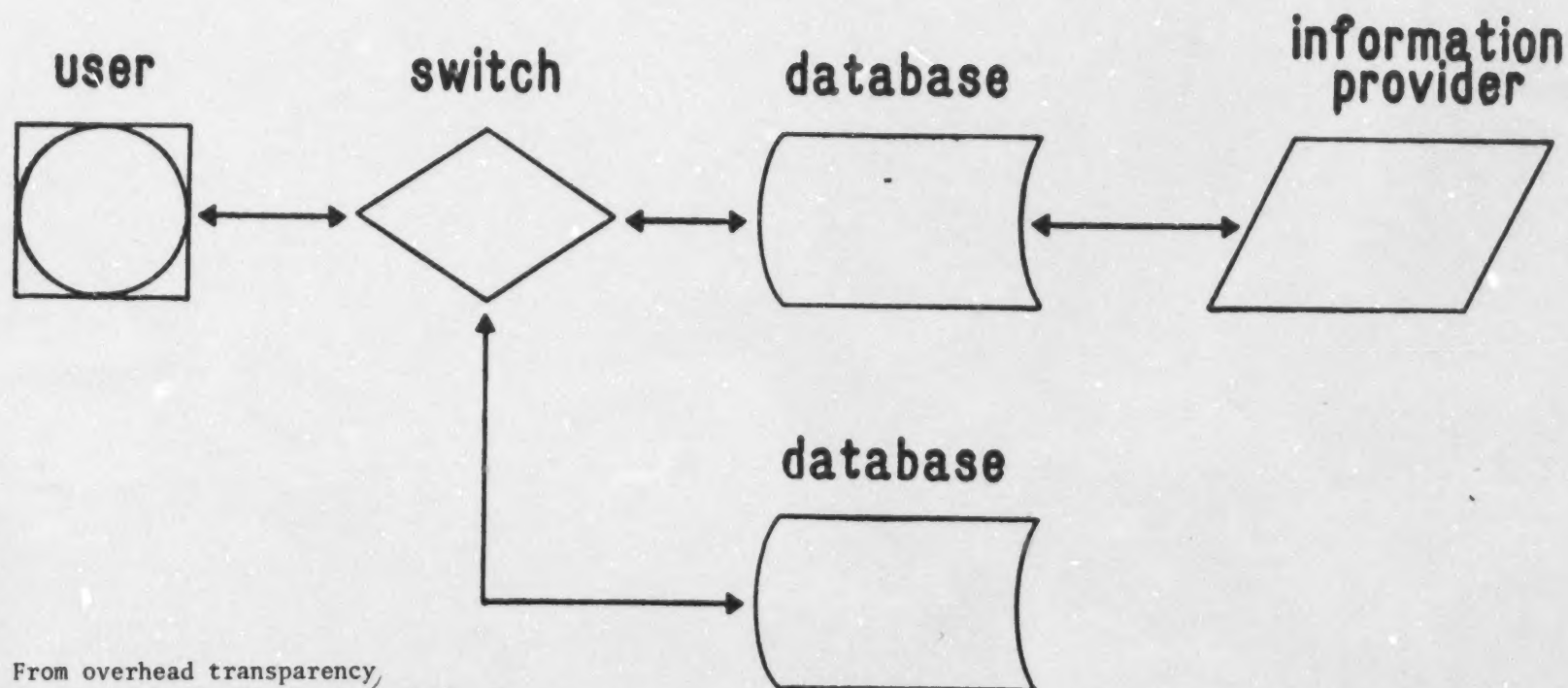
1. a source of information remote from the user, in the form of computer-based information;
2. a connection to the source via a telecommunications link, such as a radio wave, a coaxial cable, a copper wire, or an optical fibre;
3. an information display which will normally be a television set;
4. the appearance of the information in response to the command of the user as part of a large selection made available by information providers;
5. a service geared for the mass market in general, with some specific audiences included.

One-way videotex is usually referred to as a teletex or non-interactive, since the user cannot interact directly with the database. In contrast, two-way or interactive systems allow the user to interact with the data base by selecting the pages he wants for display. The version of Telidon which has been demonstrated to date is interactive videotex.

Videotex databases may currently be accessed by a series of indexes and directories relying on a tree-structure, a sample of which is shown in figure 4. Telidon tree-structure consists of a general index page which is followed by up to nine more levels of index pages. There may be up to nine choices at each level. The tree-structure has received prominent attention through promotional materials. A "tree" logo is used by Telidon in screen designs and publications,² and appears in conjunction with articles, displays, and journals featuring Telidon; for instance the cover of a special issue of the College Canada journal featuring articles on Telidon (vol. 6, No. 8, January/February 1982). (figure 5)

Figure 1

A VIDEOTEX NETWORK



From overhead transparency,
developed by D. Hlynka & P. Hurly for
a workshop with staff of the Manitoba
Department of Education, Winnipeg, Manitoba:
University of Manitoba, c.1982.

Figure 2

The Videotex System

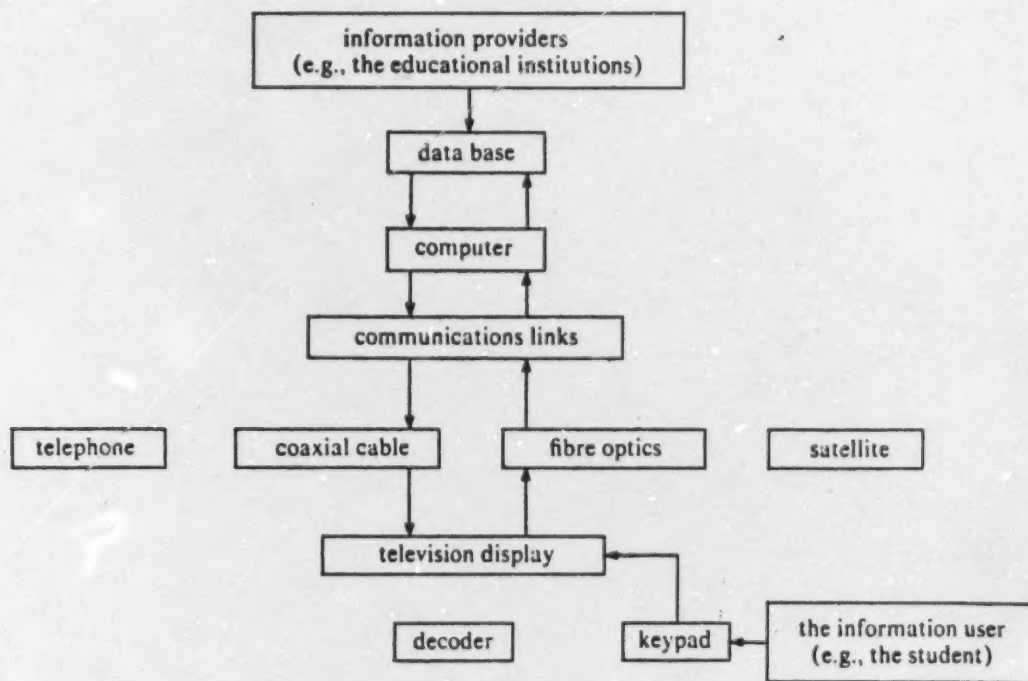


Figure 3

Telidon Information Network

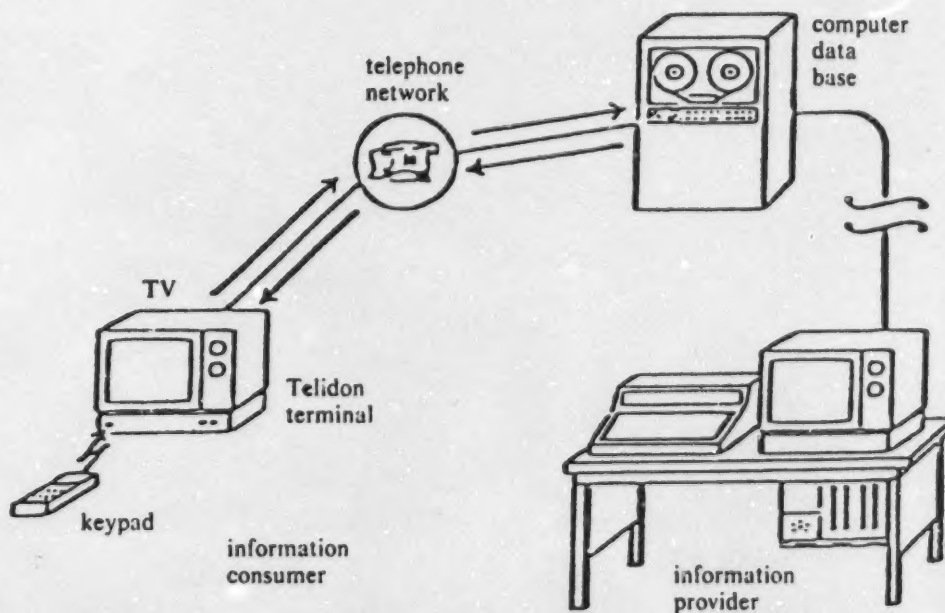
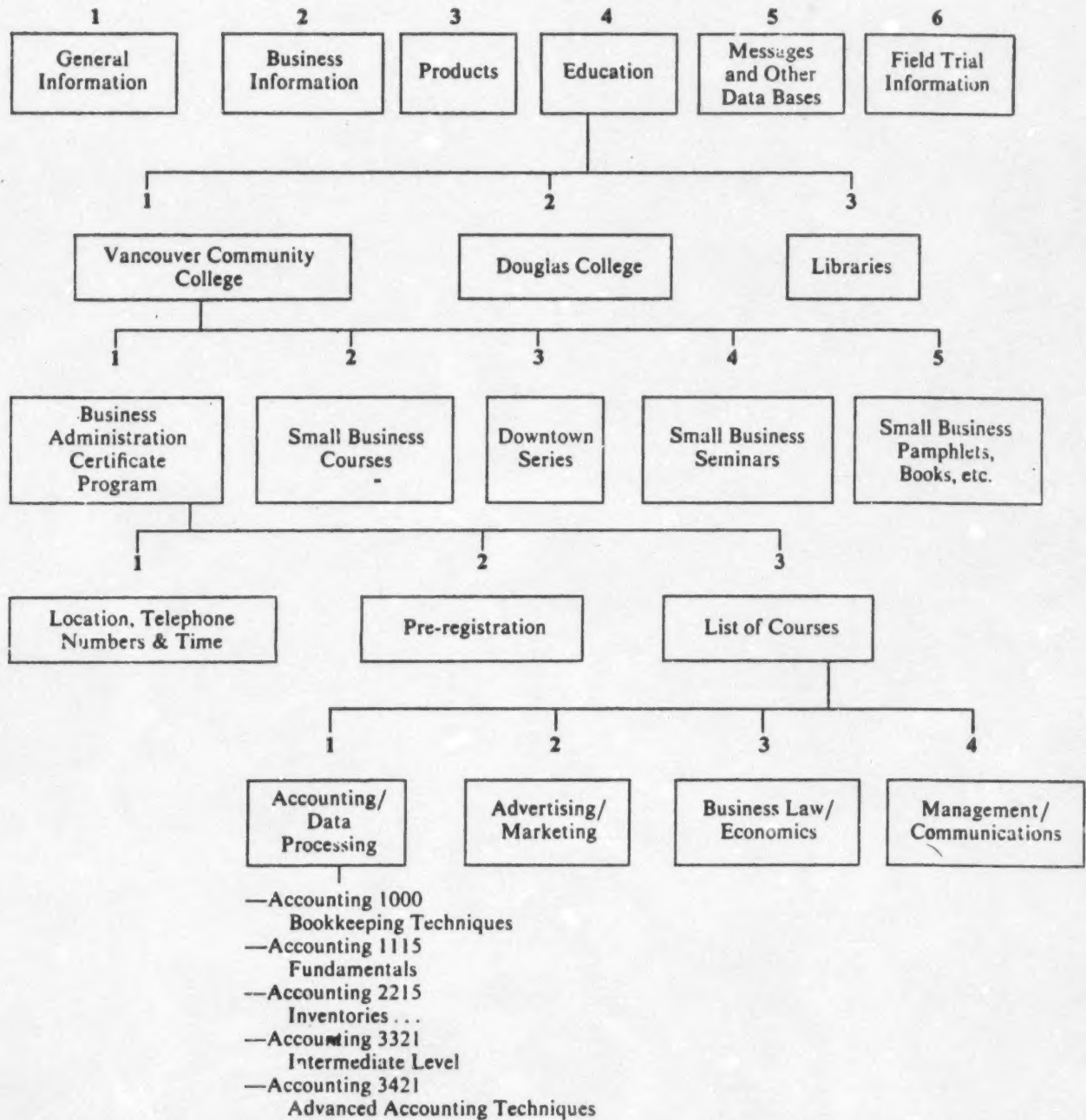


Figure 4

A Sample Tree Structure

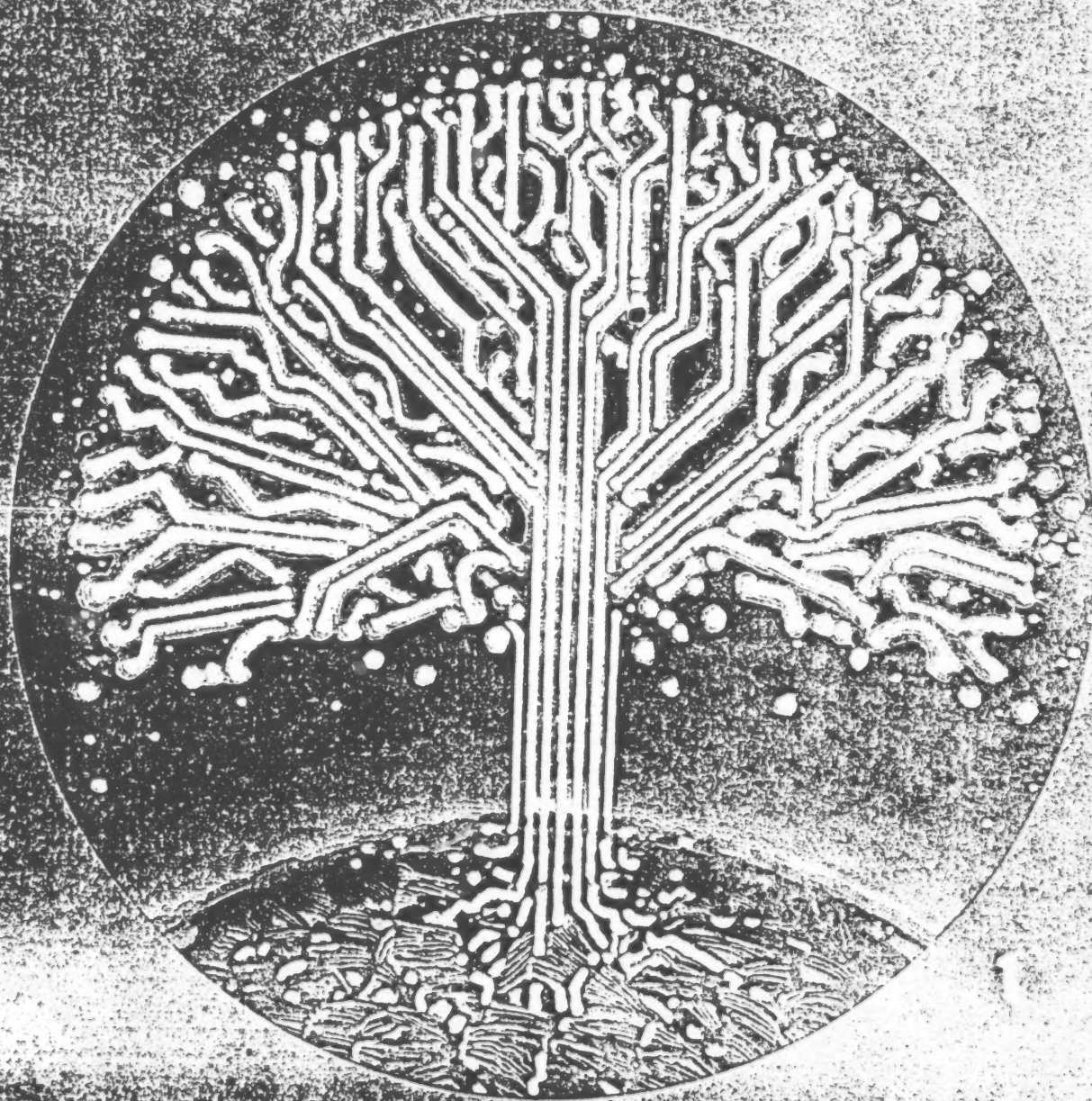
BC Telephone Field Trials



COLLEGE CANADA

TOME/VOLUME NO. 8

JAN./FEB. 1982 JAN./FÉV.



association of canadian community colleges
association des collèges communautaires du canada

Cover Illustration courtesy of Telidon, Department of Communications, Government of Canada. 11

There are two ways to reach each page in the tree which has a single address. The page can be reached through the branches of the tree that lead to it, or can be addressed directly if the user knows the particular page number. One of the problems with the tree-structure search method is that it is time-consuming, and can prove costly because of on-line time charges. It is also relatively easy to make an error in trying to get to the desired location.

The tree-structure poses a limitation for education because the database cannot presently be searched using key words or combinations of code words or headings. The user is forced to flip through the index pages with pre-set options to reach the page wanted, unless he knows or has a written or printed index of specific page numbers which allow him to key into specific information he wants.

Newer versions of Telidon, however, feature keyword access. At the University of Montreal, an experimental keyword access system has been developed. In this system, the user can, for example, type in a keyword which will provide access up to as many as ten areas in the database where relevant information is stored. The development of a keyword access system should make it easier and faster for users to find desired material.

Telidon's information-provider systems have sophisticated graphics and editing capabilities, as well as many of the text-handling features of word processors, and are relatively easy to use. An important point is that no special training or computer background is required to use an IP terminal.

A single data base is capable of serving terminals with a variety of communications media, including microwave, broadcast television, fibre optics, direct broadcast satellite, satellite relay, packet-switched networks, and video cable, without special processing. Telidon, through networking with the iNET gateway, can, for example, put literally thousands of specialized databases at the user's fingertips.

What is so exciting, then, about Telidon? Simply that it brings together in one system electronic components that allow access to one or more databases at a distance, and translates electronic pulses into video form for reception wherever the relatively simple equipment and connections are available. It allows people to use the familiar technology of television and telephone through linkage with computers in a new and promising way.

III. TELIDON AND EDUCATION

A. CHANGE AND TECHNOLOGY

Certainly education of all kinds will be, and to some extent already has been, deeply influenced by technological change. Let us look at some of the reasons for significant change in educational systems and the demands society is making of them, along with ways in which the technology with which we are concerned here, i.e. Telidon, might impact:

- . The public is becoming increasingly disenchanted with the educational system. The daily newspapers, magazines, and television reports are often critical of the school system. Surveys show continued decline in people's faith in education and its ability to change people's lives or societal status. Add to this deepening financial constraints for educational institutions, and one realizes the need for fresh approaches to learning. Increasingly, adults are looking to extra-institutional modes for education and training, which is where Telidon may prove to be a prime way in which to meet these needs.
- . Information technology such as Telidon may be one of the only feasible ways in which to supplement teaching capability in schools faced with reduced teaching staffs and larger class sizes, allowing the school to offer a broad selection of courses in a flexible manner.
- . Telidon allows learners to access information, take courses, or write tests at their convenience and their choice of location, instead of being locked into place and time as set by the institution. Theoretically, Telidon could be available in practically every home, with programs available at any time.

- . Programs on Telidon, since they are computer-based, can become a flexible system which can diagnose and respond to differences in pace, learning strategy, or learning level of students and hence be educationally more effective. Teachers and students could effectively choose from a selection of different courses covering the same area of curriculum the one that best suits the student's learning style.
- . It can provide a distinct learning track for each student for each discipline, thus to some degree helping education reach the goal of individualization of curriculum.
- . Telidon can be utilized to teach foreign-language students or the learning handicapped.
- . Telidon can provide for many of the routine aspects of education, thus freeing teachers for higher-level teaching functions such as planning, diagnosing, counselling, and discussing.
- . The demands for frequent re-training, re-education, updating or changing occupational streams by people in many job areas in today's society create a need for a technology such as Telidon that can be readily available at home or in community locations, has an easily-updated database, and can cater to the individual's learning needs and style.
- . At the same time there is a move away from studying at a traditional educational institute, and toward serving a broader range of clientele than was the case in the past, and in somewhat of a "consumer-oriented" manner. The pool of people desiring and needing study and re-training has diversified, and now includes people from many occupational areas, the unemployed, diverse language and ethnic groups, those living in sparsely-settled or core city areas, many women who in years past would not have been seeking further education, the upwardly-mobile, single parents, the elderly, the physically or mentally handicapped, immigrant people, and so on. These people regard education almost as a right, and are making consumer-type demands on the educational system to provide for some of their needs and wants.³

B. FUNCTIONS OF TELIDON EDUCATIONAL TECHNOLOGY

Information technology, in this case Telidon, is capable of taking on a major resource role in meeting needs for the delivery of educational services over the next decade:

- . It can take on roles and capabilities that the traditional classroom either can no longer handle, or was never intended to handle.
- . It can provide a cost-effective delivery mechanism.
- . Costs in regard to electronic provision of educational services will continue to drop in relation to costs in other areas of the educational budget over the coming years. It will thus be viewed more and more as a viable alternative to educational programs in institutions.

Telidon has the capacity to function as both mediator between student and learning environment, and as information flow. A useful way to examine the educational implications of the medium is to utilize an educational framework along similar lines to that Nicholas Rushby proposes in his article on educational paradigms (From Books to Bytes, TVO, 1980, pp.55 - 60). The four paradigms Rushby outlines, based on the work of Kemmis and his colleagues, are:

- the instructional;
- the revelatory;
- the conjectural; and
- the emancipatory

Whereas Rushby is dealing with CAL (computer-assisted learning), however, this discussion focuses on Telidon. Thus, while Rushby's framework is of general conceptual value, the content needs to be specific to Telidon. The following framework or paradigm is therefore appropriate:

- the instructional mode; "passive" instruction
- instructional - interactive
- simulation (comparable to Rushby's "revelatory")
- information resource (comparable to Rushby's "emancipatory")

1. The Instructional Mode: Passive Instruction

The textbook, the teacher-presented lecture, and projection media such as slides, filmstrips, films, videocassettes, and broadcast television, are all examples of passive instruction involving the presentation of information from various sources. Passive instruction has the following characteristics:

- . the providers of the instruction make all of the educational decisions: the content, length, ordering, and even in some cases the scheduling of the instruction;
- . a blurring of the boundaries, in some instances, occurs between education and entertainment. For examples, we might look at "Sesame Street" or the "Electric Company" programs for children, or a Shakespeare play, a concert, or an informational series such as "Cosmos", all of which might be considered important instructional resources as well as entertainment.

Some concerns about the use of Telidon as passive instruction, as well as benefits, need to be considered: many of the educational Telidon pages created to date serve mainly as text-presenters, the result being that a program made up of such pages serves primarily a "page-turning" function. Further, most of the page sequences presented for teaching purposes are in the format of first presenting one or more pages of text information, and then testing understanding through the use of multiple choice, often not using much creativity even for that format. Concerns about, first, the level of instructional sophistication, and second, the appropriate use of a technology which has a much greater instructional potential, has been expressed by many people in the educational technology field. On the other hand, Telidon is a new technology. Concomitant with this point is the fact that the history of technology, whether it be film, video, or other media form, illustrates that it has always taken

people time, usually many years, to discover the unique properties and capabilities for presentation on any given medium, and with most media that process of discovery is one of on-going evolution. Telidon has to have a similar time-span in order to allow experimentation and discovery of prime ways to utilize its capabilities, and new ways of presenting information and providing instruction on it. Just as computer-based education had to evolve, and is still criticized for its preponderance of "drill-and-practice" materials, Telidon needs a similar opportunity for trial input and creative development. Telidon is obviously much more than a medium for transmitting text, and a great deal remains to be learned about the cognitive and affective aspects of instruction using this new medium. Different types of instructional design and page design are required from those developed to the present if the educational potential of Telidon is to be fully exploited.

Further, educational decision-making placed in the hands of the page-providers is a major concern. Martin (1981, pp. 188-9) points out that a new industry producing educational products is developing that "could be a force for conformity, a trivial medium for idle distraction, or a medium that encourages learning across an immensely broad and diverse range". Which of these it is depends on what monies and direction are put into development, and what laws encourage or restrict educational materials development.

A point to be considered is that much of the material presented as instructional is based upon the tenets of programmed instruction, i.e. the breaking-up of learning tasks into many small steps, concentrating upon each in turn, with student reinforcement each time a step is mastered. This approach makes a number of assumptions about the nature of the subject matter and the ability of the student to assemble the many small steps into a cognitive whole. It also assumes that students conform to a behaviourist learning model. Used with Telidon, this paradigm may also pose problems

in implementation. The preparation and delivery of small learning steps places great demands on instructional designers, may require extensive database accommodation, and may not have sufficient appeal to motivate the home student to work through a lengthy series, not to mention control of student progress, checking understanding at each step, and general management.

2. Interactive Instruction

Interactive instruction may be defined as any program in which the sequence and selection of instruction is determined by the user's response to the material. With, for example, a traditional linear program, the user remains passive. The learner's participation is a critical factor in an interactive program, however.

Learner involvement may take a number of different forms, in particular when Telidon is combined with other media for student use. Within the same module, a number of routes or alternatives may be available to different users, and the route followed by an individual may vary significantly from that followed by any other individual.

Interactive instructional technology has the following characteristics:

- . the rate, sequence, and selection of information is a product of the user's active involvement with the program;
- . instructional programs are divided into discrete packages, each designed to teach a specific skill or develop a particular area of understanding or information. An instructional curriculum such as introductory biology is a collection of these packages, often extensive. Design effort, involving breaking each unit into frame-sized pieces or sets of slides, video or film segment, is needed. Testing and feedback, as well as anticipation of student routes, is also required;

- . because of the nature of the design process, interactive curricular packages are not generally useful for any clientele or purpose apart from the specific ones for which they were designed;
- . the skills required both to design interactive curriculum units and to assist students in their use are substantially different from traditional teaching skills.

In many ways, the use of interactive modules for learning is desirable because of the enhancement they offer to the learning process. However, as can be seen from the characteristics outlined, to make interactive learning an everyday reality for the school system and/or the general population poses huge problems because of the specificity of its nature and the extensive effort required to design and produce units and provide a range of programs to the learner. Because it fundamentally changes both content configuration and the way material is-presented, use of a computer-based system such as Telidon may require massive changes in course content or even broad re-definition of the curriculum and the teaching act.

Further, the present version of Telidon is not as interactive as it needs to be and could be. At present, the system "interactivity" means only that the individual can select what he wants from the database. As the Social Impacts Committee of the Canadian Videotex Consultative Committee has pointed out (1982), "present Telidon applications may lock us in and preclude the possibility of future changes. A move to greater interactivity may seem some time in the future to be 'too costly' and thus Canada will have missed an opportunity to take advantage of Telidon's full potential as a communications system." (p. 7) The Committee lists the following capacities as essential (p. 8):

- . input of information by users;

- . terminal-to-terminal communication between users (direct or "store and forward");
- . transactional devices;
- . loading of computer programs from a database into a terminal;
- . interconnection with other related services;
- . management of closed user-groups.

Some of these capabilities now exist; others are under development. Hopefully the system will eventually be able to encompass all of the above capacities.

3. Simulation

Simulations are programs that can be used to create a special environment - a language, pseudo-situation, or data-base - that can be manipulated by the student. LOGO, for example, provides students with a special computer language that can help students develop problem-solving skills. A simulation such as presenting caricatures of a family of space creatures which the students can match up so as to observe the appearance of particular genetic characteristics can provide a student with the opportunity to observe and learn the workings of Mendelian laws in a relatively brief period of time. Visi-calc provides a spread-sheet and database by means of which accounting principles and financial planning techniques can be learned.

The above examples are currently-available computer software. Visi-calc can cost as much as \$455 for an individual to purchase from a computer store. A broad choice of such material could be made routinely available via Telidon, and possibly reach a much greater portion of the population than do microcomputer sales. Such use of the technology as a powerful tool for learning could revolutionize, for example, the teaching of history, provided that much of it were taught as a data-based subject rather than in the traditional manner.

History is about the rise and fall of populations, the spread of innovations like the printing press and the plow, the spread of civilizations, and the political environment, all having to do with data. The student, through simulation could see the dynamics of history in action by looking at, for example, the results of doubling the economic recession of 1981-82. Similarly, economics, shop, accounting, and many other curriculum subjects could become motivating, skill-building programs for learners both at home and at school by teaching elements of the subject through a database approach combined with elements of simulation.

To sum up, Jim Feeley (p. 6) points out that Computer Assisted Learning (CAL) systems have had this ... capability, [to provide data access and interactive-learning capabilities] but existing CAL systems serve very few users. Some of the lessons learned from CAL experience will be [re-learned and] applied with videotex. But by its nature videotex functionally is suitable for large numbers of users, hence the difference and the different impact. Many factors (cost, appropriateness of content, ease of use) will influence the growth of videotex, and certainly the learning potential of interactivity is one of them.

4. Information Resource

Not only is access to information a form of power, but as Alfred North Whitehead has pointed out, education may be defined as "the acquisition of the art of the utilization of knowledge". If one accepts these statements, then Telidon can have enormous impact in terms of equalizing of opportunity for information access if the system becomes widely used and inexpensive enough for home use in a similar way to that of the telephone and television.

On-line information services have obvious advantages. In summary, they:

- . produce results very quickly;
- . are cost effective;
- . can be used for most types of searches;
- . can search fields (or data categories) for which there is no printed index;
- . have the capability for searching very complex and elaborate strategies;
- . offer the opportunity for increasing completeness of coverage through searching of multiple sources;
- . may contain information more current than available in the corresponding printed index;
- . can be easily updated on demand or at regular intervals;
- . permit any amount of strategy broadening, narrowing, or changing;
- . cause less fatigue per search and reduce searcher's errors;
- . require very little space for operation;
- . save staff time;
- . recover some kinds of data retrievable only on a computer system;
- . research many more types of information than can be searched in a manual system;
- . can order material with a simple command and charge them to an account - a copy on demand service. ⁴

As Rushby (1980) points out, the use of information technology in this manner is a means of reducing the "inauthentic labour" involved in the learning process, (p. 60), and can also be useful in supporting the teacher in the management of learning.

Probably Telidon's greatest potential for education in its broadest sense lies in its capacities for information storage and retrieval. Libraries of today simply cannot acquire and house all published material even on a particular topic.

Virginia David (1981, page 4) points out that:

With a Telidon system, [access] would begin to come within reach, for no longer would it be necessary for one publisher to print thousands of copies of the same book. All he need do is enter the book into the available database, properly catalogued, of course. Then when a user wished to read the book, he would call it up on his Telidon keypad and have it displayed on his home or office television screen, or printed out in paper hard copy. If the user did not want to tie up (and pay for) the transmission lines until he was finished reading the book, he could "download" it into a small computer memory on the premises and call it up locally as he needed it. The user need not store the book in memory permanently because it would be cheaper to simply call it up again, even on a daily or perhaps hourly basis. Resource libraries could easily become obsolete, at least as we know them today. Students would have access not only to information locally produced and entered in the database, but to any and all information published about a given topic, no matter how remote the source, or "limited" the edition.

For research or literature review, the benefits of computer searches for information are apparent. With Telidon, access to a host of computer databases would be available not only in libraries, but in schools and homes. Networks such as iNET, the "Intelligent Network", and linkages such as Datapac, put enormous numbers of databases each devoted to the storage and retrieval of particular data resources instantly at one's disposal. The number of on-line databases is rising rapidly: 1982 saw a 57% increase in numbers, for example, over 1981.⁵

There is a need to develop computer communication services which are as universal and easy to use as the telephone. This need, of course, can be efficiently addressed by the Telidon system, with gateways such as iNET providing the essential link between the user at home, school, or library, and a vast array of databases which can include services such as electronic messaging (Envoy or a similar service), banking and marketing, common interest groups, and service bureaus, ⁶ as well as informational databases such as those of the National Research Council, the Financial Post, university library holdings, the Library of Parliament, and on and on. Currently iNET has 335 subject categories available for searching. The Computer Communications Group (CCG) of the Manitoba Telephone System has completed a listing of Science and Technology databases currently accessible, including, for example:

CAS77 + B20S1S (ORBIT):

Worldwide coverage of chemical sciences literature from 12 000 journals, new books, conference proceedings, etc.

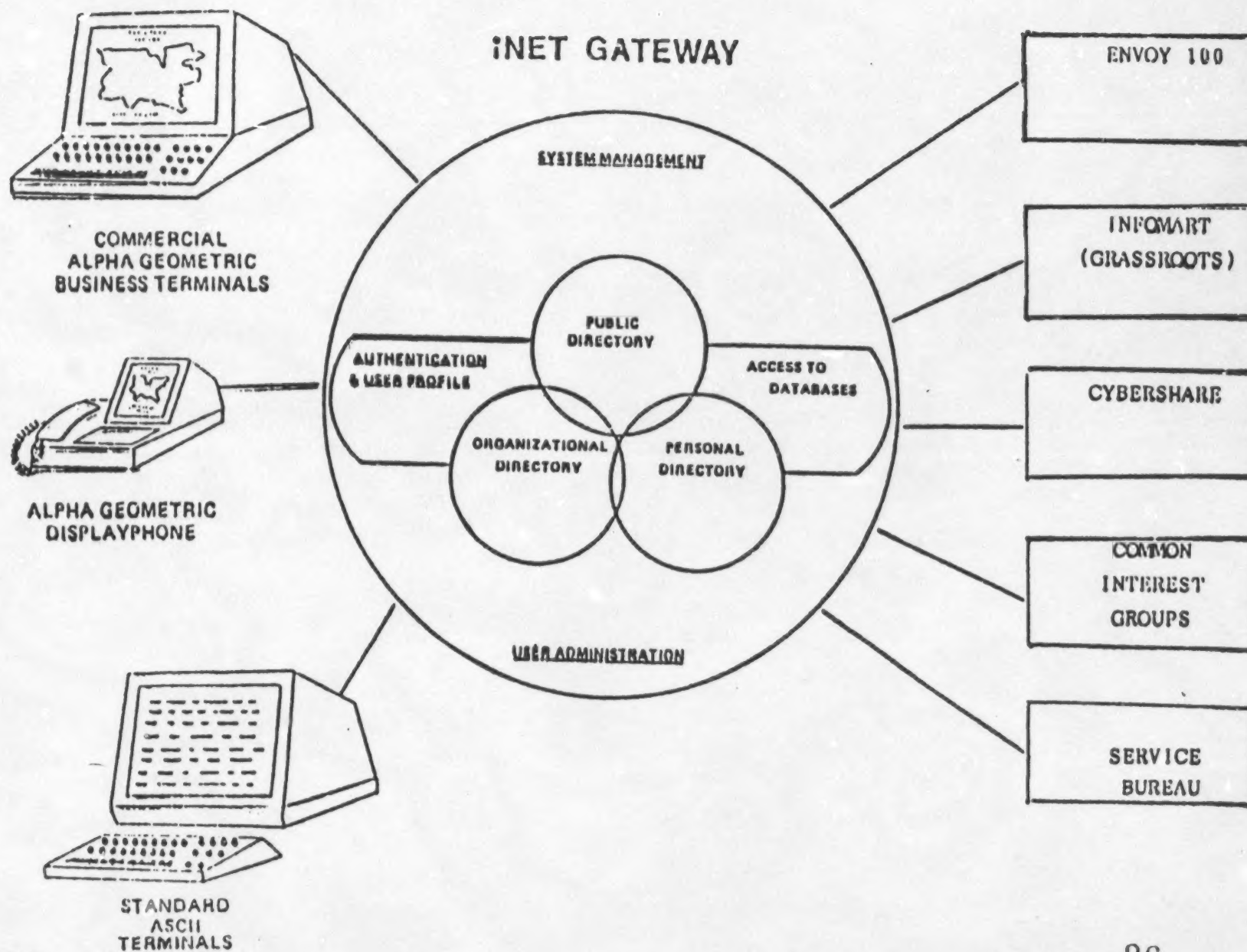
SCI (NCR/C1ST1 CAN/SD1)

Science citation index to 90% of the world's literature on science and technology. Articles, reports, letters, editorials from 4000 technical journals. ⁷

The above are only two of twenty-two entries in the science category. The CCG intends to complete lists of databases in the following areas:

- | | |
|-----------------|-------------------|
| - economics | - human resources |
| - media | - law |
| - executive | - medicine |
| - home computer | - education |
| - finance | - bibliographic |

Figure 6



Since there is a phenomenal amount of information available on each subject category, the aggregate is astounding. The number of on-line users is projected as tripling annually from a current base of 1500 users in Canada. Certainly such a facility will make great impacts on education and information retrieval in general.

Telidon can provide information-handling of another kind to education as well, in the form of bulletins and administrative information. Included here are easily up-dated resource lists, an electronic bulletin board covering events in institutions and wider community, course offerings, career information, news of recent publications, and changing regulations affecting administrative operations such as registrations.

Telidon can in particular provide the basis for the development of a range of informational skills for students. It lends itself to study on the nature of information, its classification, organization, and sources; retrieval skills; use of indices; planning and logical search; skimming; advanced reading skills; and general awareness of information technologies.

An interesting further point is that Telidon could well be used to support what Rushby (1980) terms "computer-assisted serendipity" (p. 60) as a form of learning. The simplest form is browsing. However, as we see in the case of iNET, large quantities of information can be stored and structured in such a way as to facilitate inquiries and explorations on a number of topics. Rushby (p. 60) urges us to be aware, however, that "the mass of raw information and the cross-linking necessary ... is vast, and unless topics are severely restricted, needs phenomenal resources set up before the system is fully useable".

Clearly, then, Telidon can be used to deliver education in many new ways, both as a main source and as an adjunct to many teaching and learning styles, including passive and interactive instruction, simulation, and informational resource. Further, as James Martin (1981, p. 177) so optimistically states, the technology can provide "two benefits of great importance to society. First, the skills of the few, rare educators of superb quality can be made available to millions. This is an amplification factor that will greatly increase the levels of education in society. Second, small communities and areas far from the sophisticated centres of learning can be given access to excellent instruction. The village one-room school-house could provide high-quality education because it will combine the love and attention of a dedicated teacher with telecommunications access to the best instruction in the world".

Yet another way to conceive of Telidon's role in education is to see it in combination with other technologies. It is a truism in education that no one technology can serve all of the functions needed to provide educational services to students. In education, one of the principal benefits of information technology will and can be realized by combinations of the technologies ⁸ rather than by use of a single device. Nowhere, perhaps, is this benefit more apparent than with the use of Telidon. Telidon is itself an example of such a combination, since it inter-links telephones, television, computers, and broadcast systems. The addition of a page creator, an input terminal especially developed for this purpose, or page creation through mainframe or microcomputer via software programs written to allow such page creation for Telidon ⁹ allow the Telidon system to be utilized in five modes: ¹⁰

- a) As a videotex system - as an international standard on which to base inexpensive, interactive video communications systems which permit information retrieval, computer assisted learning, electronic mail, buying and selling goods and services, using existing phone systems or enhanced cable systems.¹

- b) As a teletext system - again as a standard on which to base inexpensive information and data dissemination systems, using TV broadcast and cable technology.
- c) As a terminal - specially built or enhanced, stand-alone or networked, permitting interactive, selective, or automated display of information (sometimes with accompanying sound).
- d) As a graphics creator - in electronic graphics creation technology, facilitating the creation of sophisticated video learning modules.
- e) As software { enhancing existing computer programs to better present graphically alphanumeric data from electronic data-bases (such as management information systems, process control systems, computer assisted learning packages).

Schools, universities, and homes could make use of Telidon in all of the above modes to deliver or enhance educational programs, and to teach areas such as graphics, computer graphics, design, art, or the development of learning modules.

To take the idea of combining technologies a step further, Telidon can also be linked up with media such as videodisc, videocassette, film, or audio via telephone or audiocassette to provide an impressive information system for education. An example is teleteaching using Telidon to transmit the necessary visual portions of the information. By itself, teleteaching is often less than impressive; an audio connection lasting longer than ten minutes with no visual input cannot compel the attention of listeners sufficiently to continue the necessary focus of attention. However, visuals presented on Telidon at the command of the teacher can provide basic information, a changing flow of information (e.g. a "past", "present", and "predicted" set of figures via bar graphs or charts), or information that cannot be presented in any way except graphically (for example, and animated sequence showing fluid flow or load stresses on structures such as bridges) as well as keeping attention focused.

C. EDUCATIONAL COMMUNICATIONS

Various combinations of communicators are possible (and desirable) for videotex utilization as an educational technology. D. Phillips (1980) has devised an interesting way of conceptualizing interpersonal communication using videotex. Applying her terms to the educational scene results in the following schema:

1. Many-to-one communication

The most prevalent mode, this encompasses a range of educational services (e.g. information of all kinds about educational programs, registration services) for retrieval by the user, as well as archival and bibliographical on-line databases, and information about current events of use to education. Librarians and educators may play an important role in determining what is included in and needs to be discarded from the databases.

2. One-to-many communication

For the educator, writer, artist, or publisher, Telidon becomes a form of publication. New media such as Telidon can create new forms of publication in the older media. An example is Videotex magazine which serves to review the content of videotex databases and report on experimental programs and findings.

3. One-to-one communication

Telidon can also place two individuals in communication with each other. In education, the following applications can be used:

- . student responses or results on tests transmitted to the teacher, with subsequent diagnosis and prescription of progress or remediations;
- . tutorials provided by the teacher to the student on the particular points or concepts with which he needs assistance;
- . messages written and stored by either teacher or student for later retrieval;

- . student-to-student contact. Telidon has the potential to provide a common viewing mode where each person sees the same information and can interact with it, build on it, or use it as the basis for a design project. Such programs as educational games can be used through the individuals interacting using Telidon as a game board and score-keeper, in some instances even when the individuals speak different languages.

4. Group-to-group and network communication

Various configurations of people in different group sizes can potentially communicate using Telidon. Microcomputers with modems linked up to telephone lines could provide access to a variety of educational programs either in the school system or the home. If Telidon becomes common in homes, as Phillips (p. 5) points out, it is possible that "colleges of common academic interest will arise; one can imagine students of all ages with a common interest such as microcomputers, mathematics, or philately using Telidon as a common communications mode".

ISSUES AND CONCERNS

Telidon, as does any new medium, faces problems and constraints that determine the course of its development.

A number of people have explored issues and constraints that they see in relation to Telidon. Godfrey and Chang (1982) list nine major points in their article in College Canada. Roger Elmes (1982) lists ten general points and nine specific ones. Hurly and Hlynka (1982) cite the following factors which may affect the dissemination of videotex in North America:

1. General factors affecting the adoption of innovative technologies;
2. Fear of a computerized invasion of privacy;
3. Economic factors such as the cost of acquiring the technology, high interest rates, the economic recession, and the nature and cost of billing for the service;
4. Superiority of microcomputers for specific functions;

5. Lack of database diversity;
6. Poor service;
7. The increasing security vulnerability and susceptibility to crime posed by centralized computer systems; and
8. The nature of regulations established to govern videotex industry.

Educational concerns in regard to Telidon focus on issues such as these:

1. While secondary and post-secondary educational use can be justified at least to some extent by the development of applications that make use of the system's communications possibilities, problems with cost and the dearth of relevant materials suggest that, in spite of its attractions for use with young children, it is not a viable resource for elementary schools at present.
2. The system of indexing reflects the fact that the system is not developed specifically for educational use. Subject-indexing is not currently available on the system except for broad general terms through iNET. A common experience is to come across informational pages by chance, and then not to be able to re-locate them. Similarly, the size of the database is difficult to comprehend when it is based on a tree-structure.
3. For this technology to be effective, the content needs to be of top quality. Educational material being presented to a learner by electronic means such as Telidon needs to be designed by content specialists, instructional designers, and producers who work together and can then evaluate and rework the courseware until a satisfactory product is developed. Those constructing the courseware have the challenge of creating a series of relationships that are stimulating, maintain interest, and are based on a pedagogically-sound structure. Presently, the information/courseware available is often incomplete and arbitrary in nature, and there is insufficient material to develop a course of study. Both the technology and the content need to be in place before the educational field can become engaged in Telidon use to a significant extent.

The design element is a crucial one with which we have not yet begun to grapple. An outstanding program for this medium would be a work of great worth. A sense of style appropriate to the medium is needed. No such sense of style has yet been apparent; the medium is too new for that to have happened.

4. Trial and experiment are essential before we will have data in regard to Telidon of what we can utilize and where this technology fits in education. Gaps in our knowledge could lead, and have no doubt led, to inappropriate implementation and negative effects on both learners and institutions.

As we have found in the field of CAL, data of sufficient quantity and depth may take many years to develop. Because of the diversity of subject disciplines, types of learners, levels of material, and learning structures, general findings applicable to the overall implementation of a technology are not feasible. The impact on learning experiences for students is often as diverse as the students themselves, and must be evaluated carefully over the long term before answers to questions of effectiveness are evident.

Instructional designers have learned that no medium exists that can perform all functions. This principle is as relevant regarding the application of Telidon to education as it is in regard to other media.

Educators need, then, to work in depth with this new medium so as to explore its strengths and weaknesses and evaluate it so that it can be applied to the appropriate areas of need in serving the public through education.

As Marc Tucker (1983) points out in his excellent analysis and policy paper regarding computers in schools, perhaps the most important task for educators is not to look at how Telidon might be used in the schools, but to begin with the question of what are the prime needs of education, and then to consider the best ways to meet those needs. If Telidon can serve some of those needs better than any other means, then educators ought to work with and help develop that system with the needs in mind. Telidon might best serve education through:

- . helping students locate, acquire, retrieve, and apply information and data;
- . develop problem-solving abilities;
- . develop creativity in thought and action.

CONCLUSION

What is revolutionary about videotex is that it can make computer power and the information sources entailed available to the non-technical person at home, at work, or in learning institutions. Its simplicity of use, possible economic viability, and potential for putting access to a vast array of databases at our fingertips are key characteristics that make it eminently appropriate not only for general use, but for educational purposes.

While much of the discussion surrounding Telidon to date has focussed on hardware capabilities, we as educators must provide input and action in regard to design, planning, and utilization considerations if the technology is to eventually serve the needs of education.

- ¹ p. 5, Informational Technology and its Impact on American Education
- ² See, for example, the inside back cover of the glossy 23-page publication called "Telidon" printed and distributed by the Department of Communications, Government of Canada in May 1981.
- ³ Examples include the huge surge of interest from the public which TVOntario experienced in response to their announcement of the Computer Academy offered to the public, in which testing initially to be offered on the Telidon system instead had to be integrated into the courseware to be run on the home computer due to the overwhelming numbers of people signing up for home use of the course. Another is the entire "public participation in education" movement evident across Canada. See, for example, Maureen Hemphill, Manitoba Minister of Education, in "Climbing Out of Education Ruts", Canadian School Executive, April 1983, pp. 22 and 23.
- ⁴ From Informational Technology and Its Impact on American Education, p. 240.
- ⁵ V. Gupta. "iNET Presentation to the CVCC Educational Sub-Committee Meeting". April 8, 1983 (unpublished paper), Winnipeg, Manitoba, 9 pages.
- ⁶ See figure 5, from Gupta, p. 6. The figure illustrates a configuration presently being made available through iNET with Telidon providing the systems management component.
- ⁷ Gupta, p. 7.
- ⁸ See, for example, Martin (1981), pp. 181-82 for his description of an elaborate arrangement for teaching students in widely-scattered classrooms. He describes an IBM facility where the teacher sits in a specially designed television studio with audio connections with students. The teacher commands use of three cameras which can show the teacher's face, the entire room, charts, books, notes, the teacher's handwritten notes, colour drawings, or programs, with four-monitor feedback and input into the two video screens the students can see. The teacher can also record the lesson for later analysis.
- ⁹ Examples of other systems and software which can accommodate Telidon page creation are microcomputers such as the Apple, Commodore, and Radio Shack with an interface card, the North Star Horizon with its special software program, and the ORION V. Natal, a computer language under development by the National Research Council, is under trial for use in programming educational Telidon at several locations including the University of Victoria and the University of Montreal.
- ¹⁰ From James Feely's "Telidon: A New Technology for Teaching and Learning", p. 2.

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